Chapter 12 Probability p. 655 1/6/12

12.1 Randomness and Probability

"fair" – everybody/everything has the same chance

Inv.

	Longest String	
	Sequence A	Sequence B
1		
2	H	
3	T T	
4	H	
5+	H	

	Second Longest String	
	Sequence A	Sequence B
1		
2	T I I	
3	H I I	
4		
5+		

	Number of Heads	
	Sequence A	Sequence B
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Ex A.

MATH PRB randInt(1, 6, 300) $\overrightarrow{STO}$ 2nd L1 enter

STAT PLOT 1 ON Hist

Window xmin 0
xmax 7
xscl 1
ymin 0
ymax 300
yscl 10

Error
1 Quit
2 Goto ←

Experimental probability - things that happen in an actual experiment

Theoretical probability - from everything being fair

Outcome - result, what happened

event - desired outcome

Exp. Prob $P(E) = \frac{\text{\# of event occurrences}}{\text{total \# of results}}$

Theo. Prob $P(E) = \frac{\text{\# of ways an event can occur}}{\text{\# of equally likely outcomes}}$

p. 661 #1, 5

Create a die roll and save it as L_1. Create a second roll of one die, save it in L_2. Add L_1 + L_2 and store the results in L_3. Graph these results as a histogram.

randInt (1, 6, 300) → L_1

randInt (1, 6, 300) → L_2

STAT Edit [L3] $L_1 + L_2$ enter

12 | 9 || 1/11

8 ||| 11 4 | 3

10 ||

2 |

4 ||

6 |||

3 |

5 ||

7 ||||

Ex. B

What is the theoretical probability of rolling a 6 with two dice?

$\frac{3}{21} = \frac{1}{7}$ 1 + 3 + 2 + 1 + 2 + 3 + 1 + 2 + 3 + 2 + 1

37 43

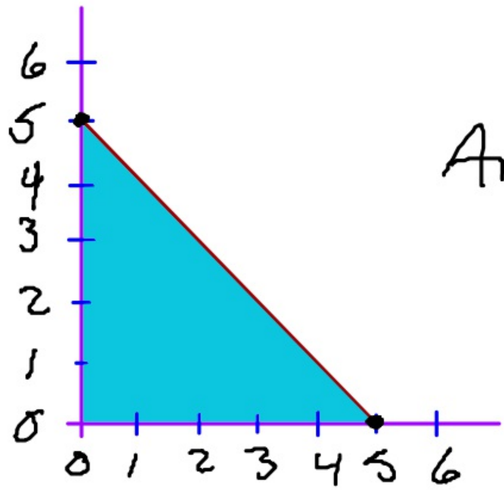
42.8
7) 300.0
20
60

$\frac{43}{300}$

Ex. C

What is the probability that any two random numbers between 0 and 6 have a sum less than or equal to 5?

0.12798

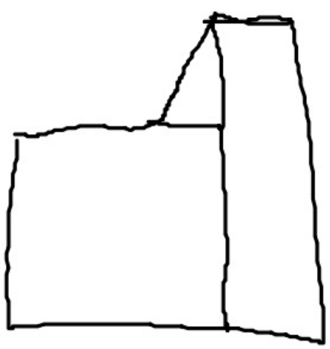


$$\text{Area} = b \cdot h \cdot \frac{1}{2}$$

$$= 5 \cdot 5 \cdot \frac{1}{2}$$

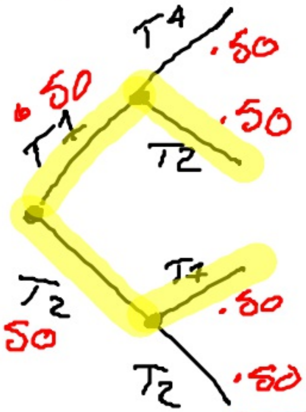
$$= \frac{25}{2} = 12.5$$

3)



pp. 662-663 #3, 4, 10

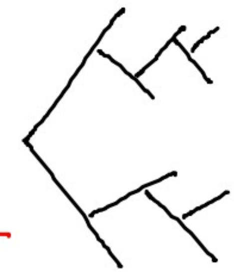
Ex A. a) 2 toys, 2 boxes



Σ 1.00

$\frac{2}{4}$ 50%

.50 x .50 = .25
.50 x .50 = .25
.50

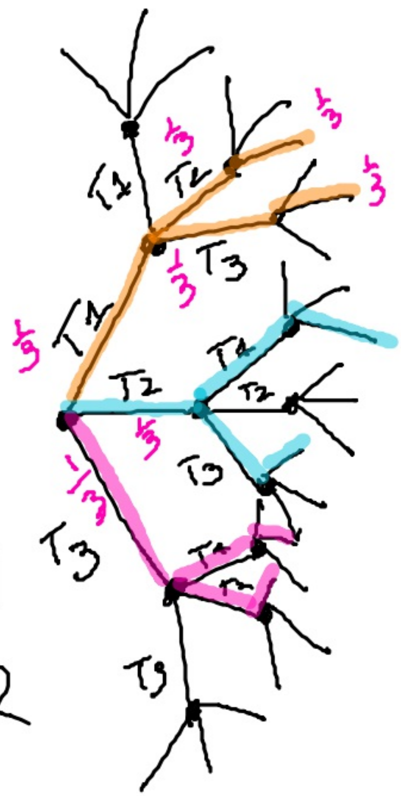


$\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{1}{27}$ 3.7%

$\frac{6}{27}$ 22.2%

b) 3 toys
3 boxes

1 2 3
2 1 3
2 3 1
1 3 2
3 2 1
3 1 2



Σ 1.00

$\frac{6}{27} = \frac{2}{9}$ 22.2%

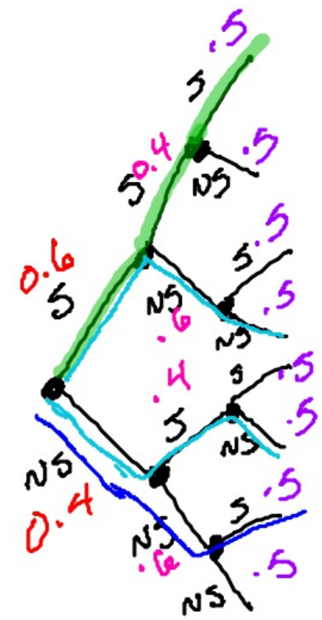
$P(n_1) \times P(n_2) \times P(n_3) \ldots$

Multiplication Rule for Independent Events

Ex B 3 classes, 3 soph chosen, one per class

	C1	C2	C3
S	12	8	10
NS	8	12	10
T	20	20	20
		8/20	10/20
P(S)	12/20 = 0.6	0.4	0.5
P(NS)	0.4	0.6	0.5

$P(3s) = 0.6 \times 0.4 \times 0.5$
$= .12 \quad 12\%$



$0.6 \times 0.6 \times .5 = .18$
$0.4 \times 0.4 \times 0.5 = .08$
$0.4 \times 0.6 \times 0.5 = .12$
$.38$

38% one soph

$\frac{1}{55}\ \frac{1}{54}\ \frac{1}{53}\ \frac{1}{52}$

$\frac{1}{20,000,000}$

Multiplication Rule for Independent Events

$P(n_1) \times P(n_2) \times P(n_3) \times \ldots$

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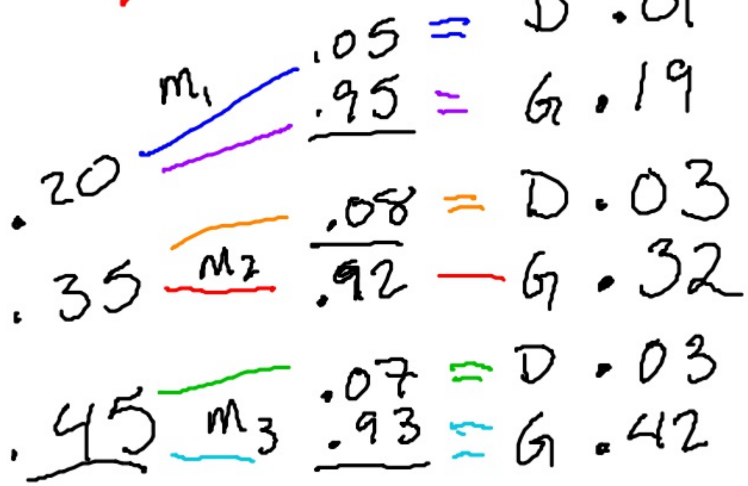
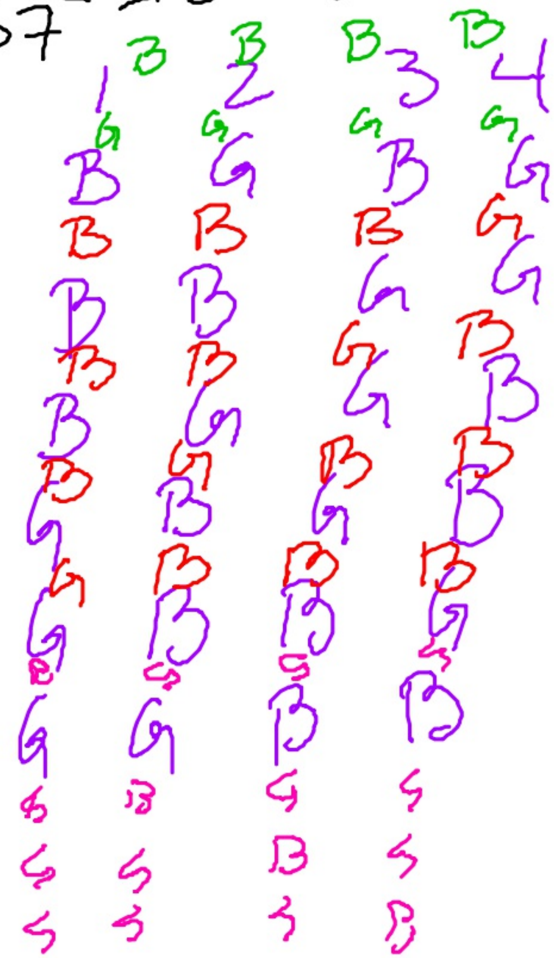
#1–4, 11, 13



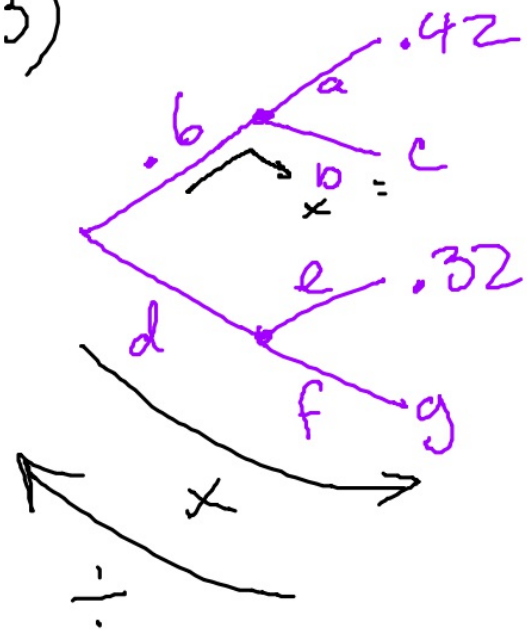
$\frac{0.03}{0.07} = 0.43$



$\frac{6}{16}$

.375

3)



$P(n_1) \times P(n_2)$

$a = .42 / .6 = 0.7$

$b = 1.0 - 0.7 = 0.3$

$c = 0.6 \times 0.3 = 0.18$

$d = 1.0 - 0.6 = 0.4$

$e = 0.32 / 0.4 = 0.8$

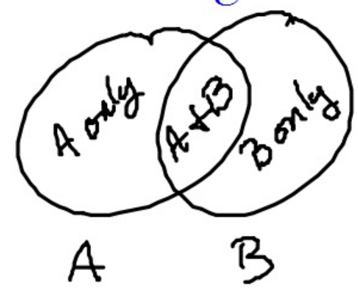
$f = 1.0 - 0.8 = 0.2$

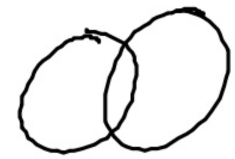
$g = 0.2 \times 0.4 = 0.08$

$$\begin{array}{r} .42 \\ + \; c \\ + \; .32 \\ + \; g \\ \hline 1.0 \end{array}$$

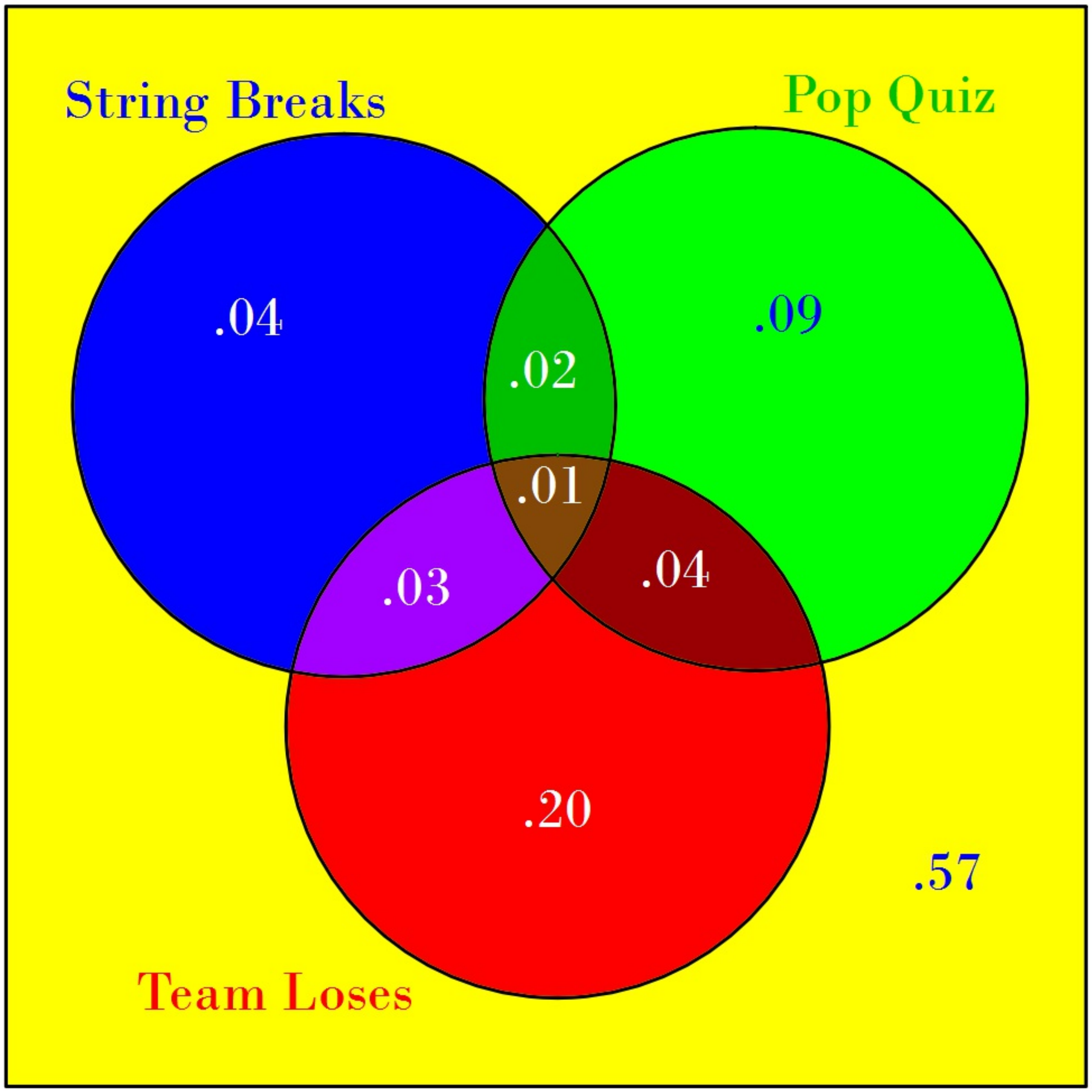
12.3 Mutually Exclusive Events and Venn Diagrams p. 679 1/20/12

Mutually exclusive -
when one happens,
the rest cannot





Ex. A

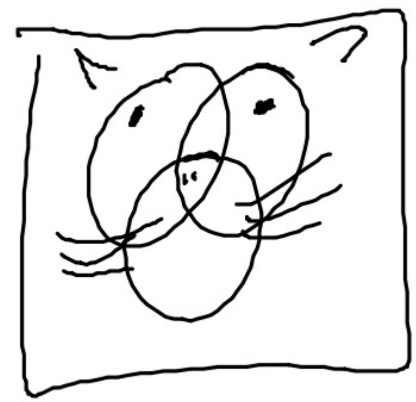


0.41 String Breaks

0.1 All 3 happen

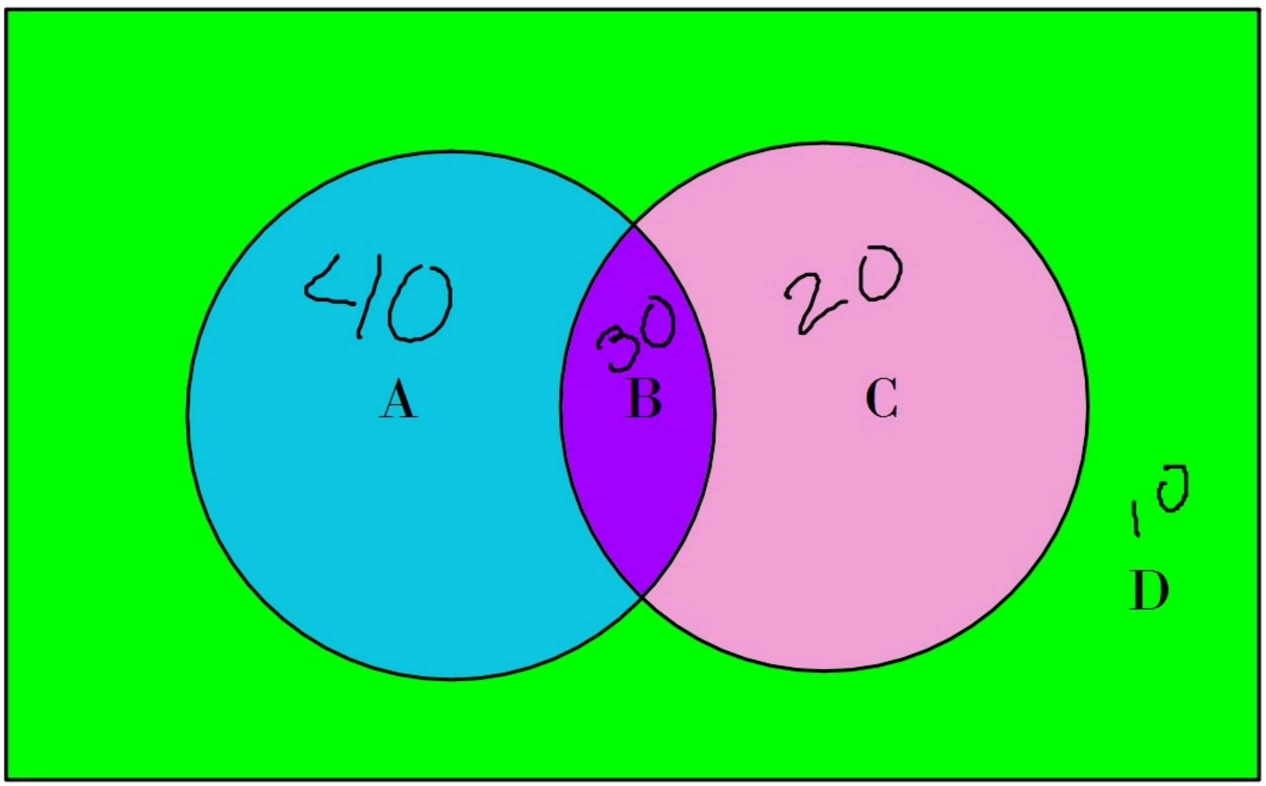
0.3 SB + TL

0.57 None of the events happen



Inv. Addition Rule for Mutually Exclusive Events

$$P(n_1 \text{ OR } n_2 \text{ OR } n_3 \text{ OR} \ldots) = P(n_1) + P(n_2) + P(n_3) + \ldots$$



D neither
B Both
A math
C Sci

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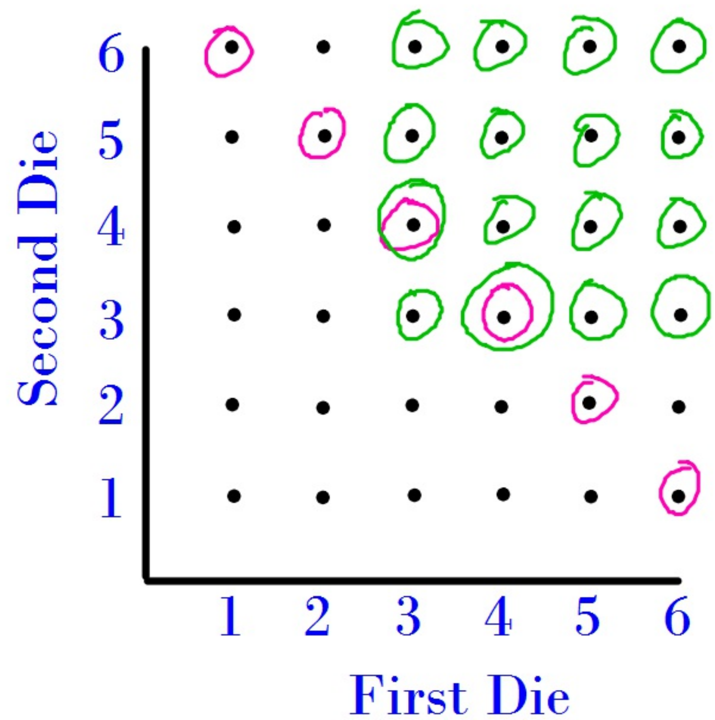
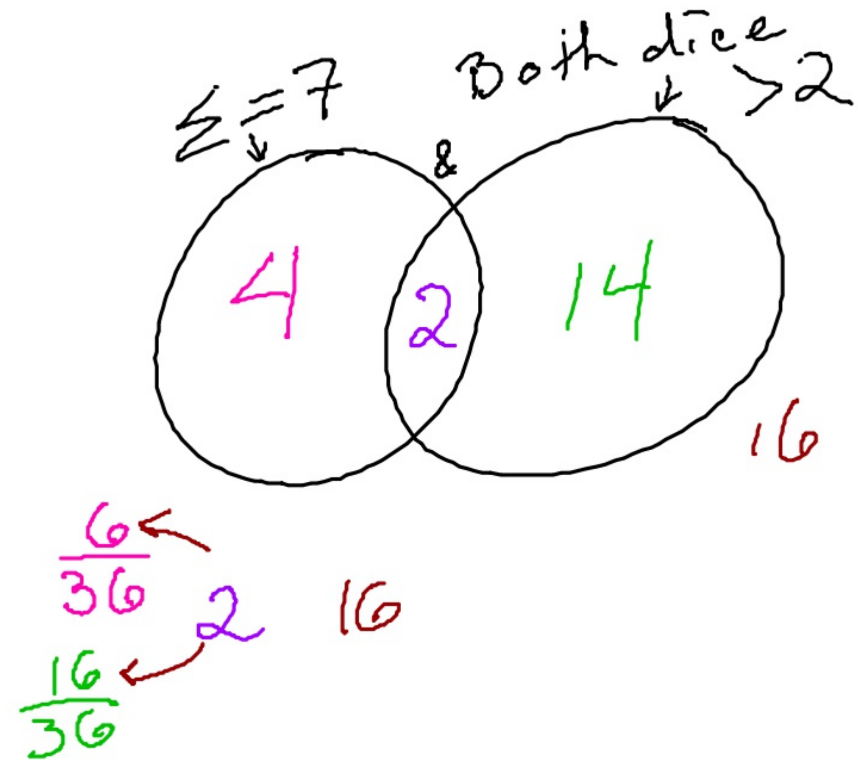




Ex. B General Addition Rule

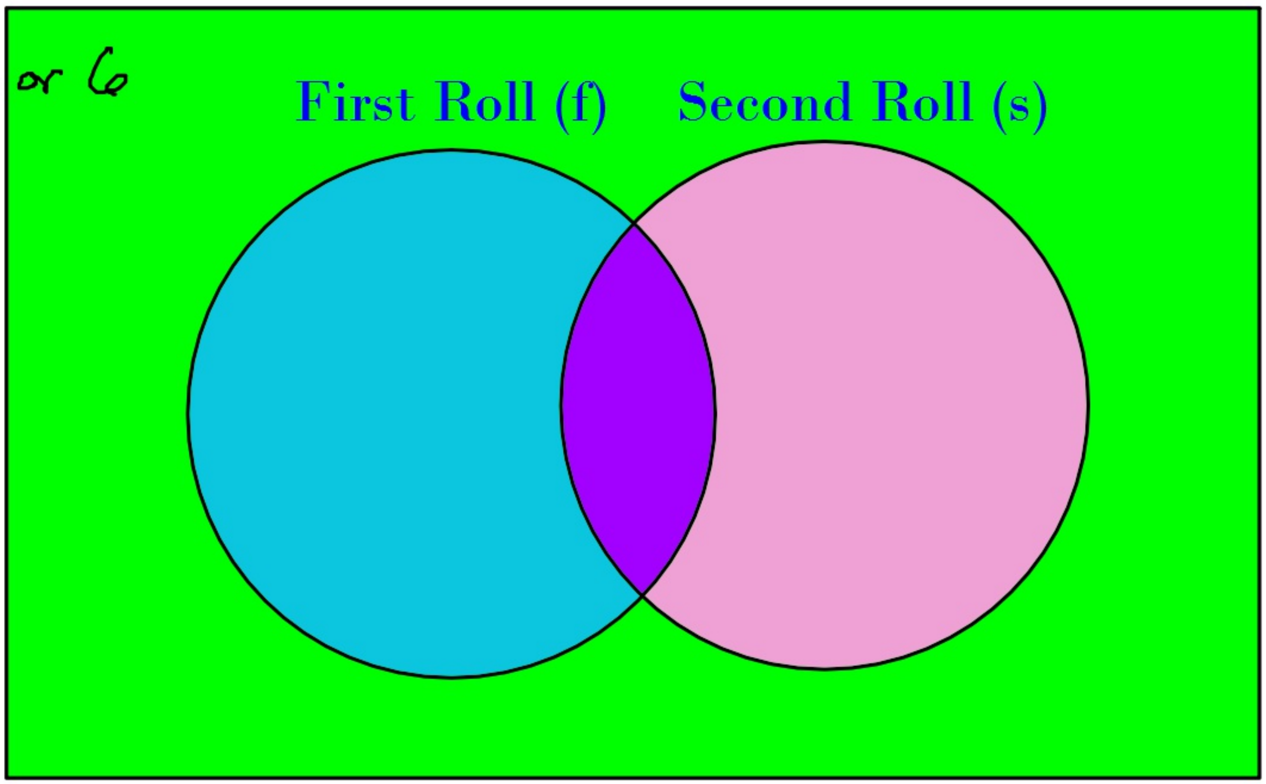
$$P(n_1 \text{ or } n_2) = P(n_1) + P(n_2) - P(n_1 \text{ and } n_2)$$

first ○ + second ○ − shared

$$P(f \text{ or } s) = P(f) + P(s) - P(f \text{ and } s)$$

$$P(f \text{ or } s) = \frac{1}{3} + \frac{1}{3} - \left(\frac{1}{3} \cdot \frac{1}{3}\right) = \frac{6}{9} - \frac{1}{9} = \frac{5}{9}$$

Roll a 3 or 6



Ex. C

$0.8 = U + W + X + Y + V \quad W = 0.8 - 0.6 = 0.2$

$0.6 = U + X + Y \quad 0.1 = Y$

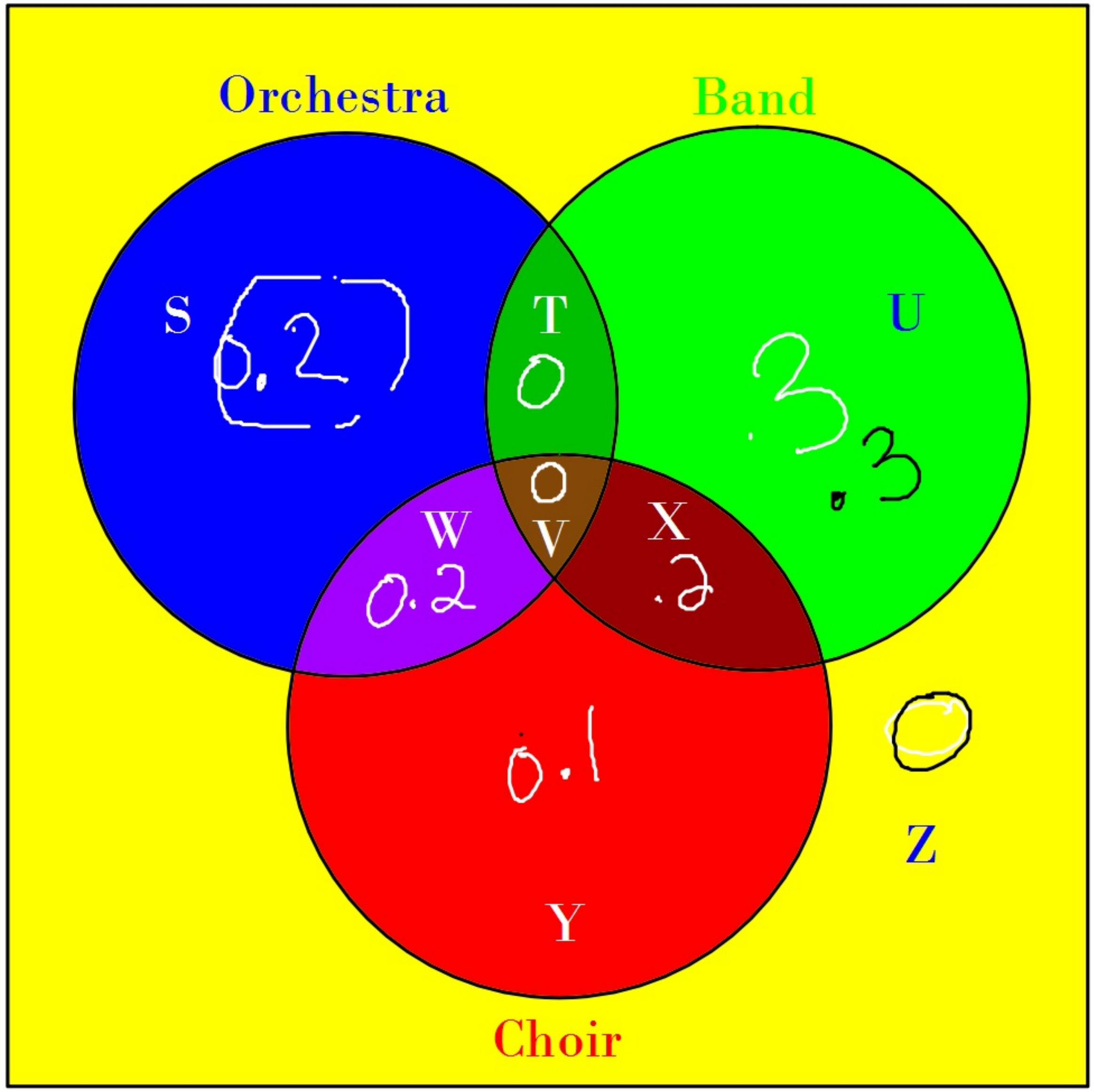
$P(B \text{ or } C) = 0.8$

$P(\text{not } O) = 0.6$

$P(C \text{ not } O \text{ AND not } B) = 0.1$

O + C are independent

O + B mutually exclusive



$P(O) \cdot P(C) = P(O + C)$

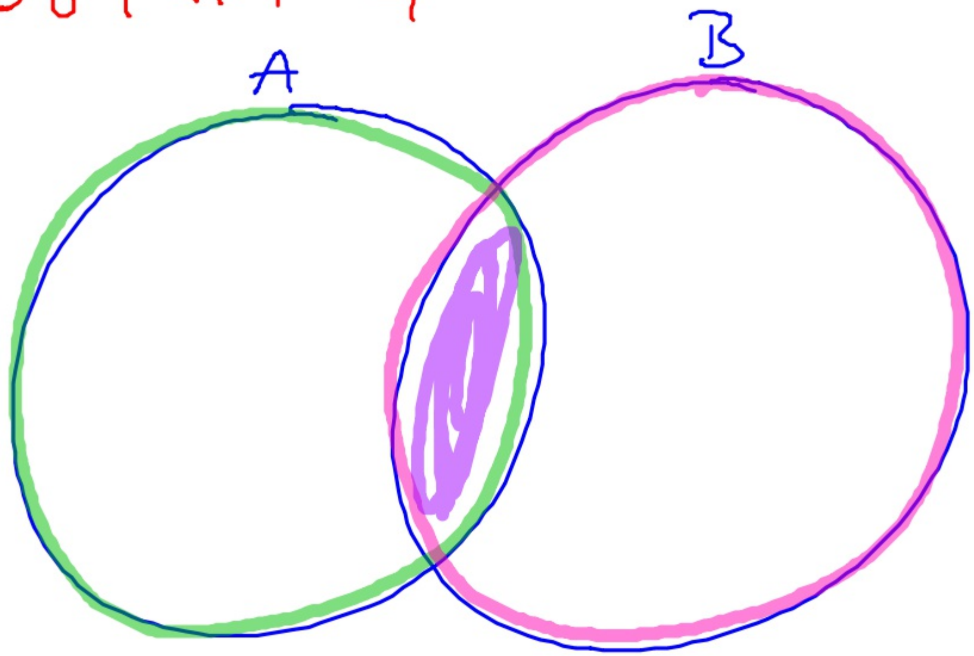
$\frac{.4}{.4}(.3 + x) = \frac{0.2}{.4}$

$.3 + x = .5$

$-.3 \quad -.3$

$x = .2$

p. 684 #1-4



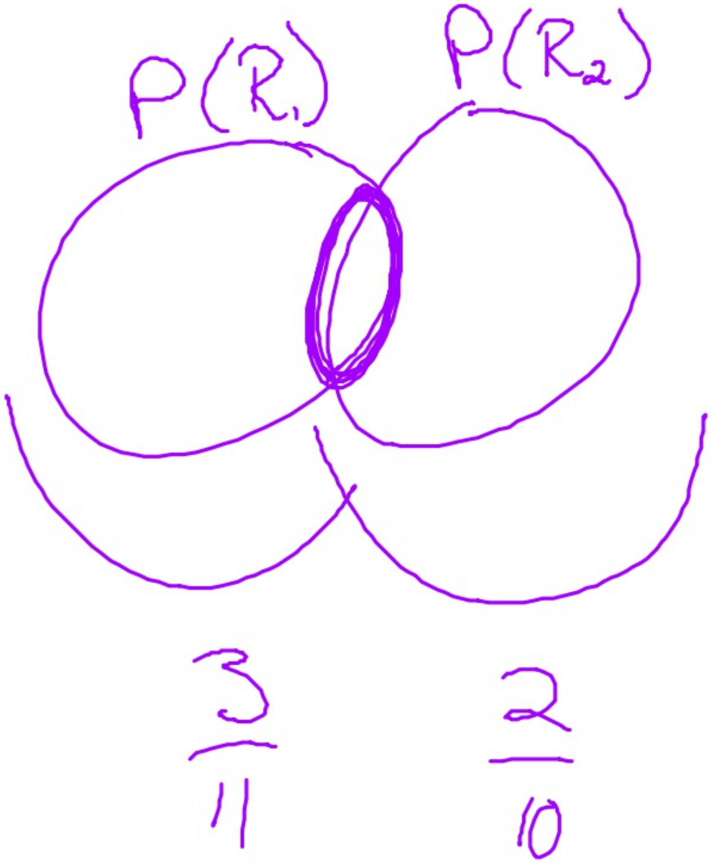
Independent

$P(A) \cdot P(B) =$

$P(A \& B)$

$P(A|B)$

$\&$ $\&$



$$\frac{2}{3} \cdot \frac{7}{9} = \frac{14}{27}$$